Intercomparison of ESRL In Situ Aircraft and Matched CO_2 Retrievals from the Atmospheric Infrared Sounder (AIRS)

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Although it was designed for high resolution/accurate temperature and moisture profiles, the NASA-EOS Atmospheric Infrared Sounder (AIRS) is capable of measuring variations in carbon trace gases such as CO_2. This capability coupled with AIRS' broad swath pattern; low and well characterized instrument noise; and global coverage afforded by a method termed 'cloud-clearing', enables derivation of the distribution of CO_2 in the middle-to-upper troposphere on global scales twice per day. Using the NOAA/NESDIS/STAR algorithm and re-processing system, we have derived global, multi-year CO_2 retrievals from the AIRS instrument. We compare these retrievals with ESRL GMD aircraft data (August 2003-Present) with an emphasis on the utility and limitations of these datasets in modeling and isolating sources of certain classes of emissions. In the upper left panel of Fig. 1 we show an example of the interpolated ESRL aircraft observations (x's along top show actual flight times) for one ESRL sites. In the bottom left we show the average of the NOAA AIRS CO_2 product within 1000 km of this site from our spatial subset re-processing system. In the upper right we show a time-series "slice" through the 6-9 km vertical layer of the AIRS data (red line), the standard deviation of the retrievals (red dashed lines), and a filtered AIRS time series (blue line). The ESRL aircraft observations are shown as triangles and the ESRL marine boundary layer (MBL) model is shown as a black dashed line. The panel in the lower right shows that the AIRS 6-9 km layer and the layer average of the ESRL measurements above 2.5 km are 91% correlated and have a standard deviation of 2 ppmv. The full resolution AIRS data has significantly better spatial sampling (24 X) than the re-processing system we have used here to illustrate our capability.
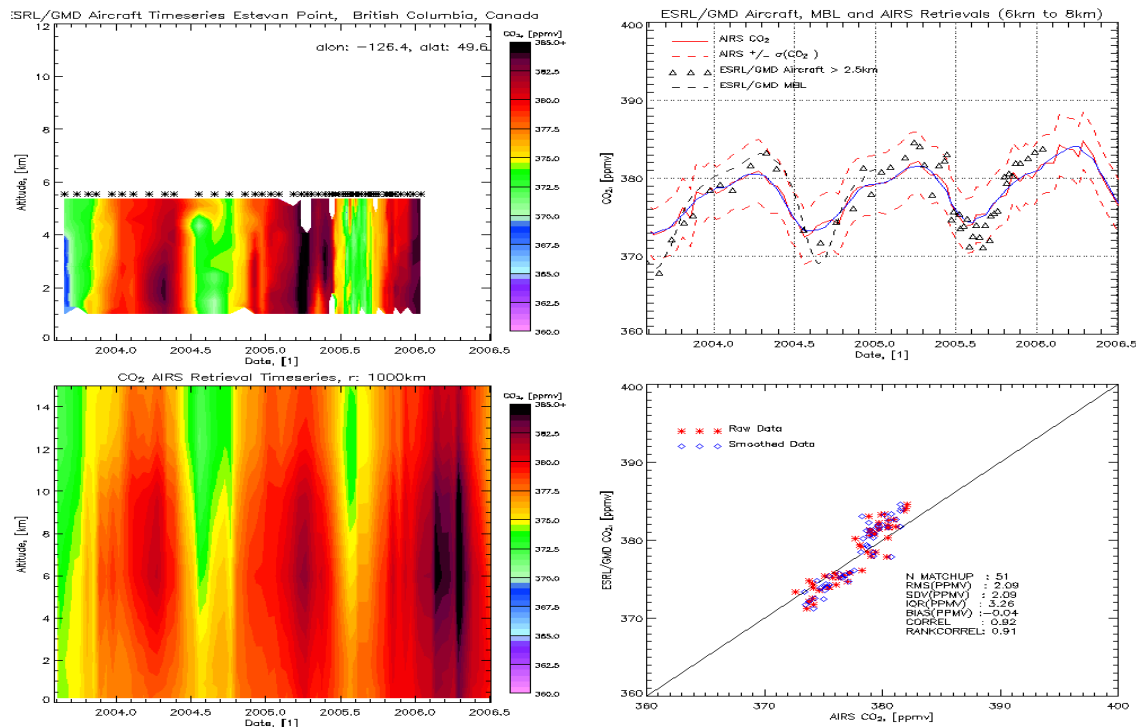

Figure 1. Comparisons of CO_2 concentrations from ESRL GMD aircraft data and AIRS retrievals.